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A2 Biology Unit 4

Populations & Ecosystems

Ecosystems -**Some definitions:** *(you must be able to use these words in sentences)*

Species a group of similar organisms capable of breeding to produce fertile offspring. Species are given a double latin name (binomial) *Felis leo* (lion) *Homo sapiens* (human)
'*Homo'* = genus, '*sapiens'* = species.
When writing these, you should use italics or underline them and use a capital letter for the genus and small letter for the species.

Population the total number of individuals of a single species in a defined area

Community all the organisms living in a particular ecosystem

Ecosystem a section of the living world characterised by a particular set of environmental conditions together with an interacting community of organisms e.g. fresh water pond, tropical grassland.

Habitat a place where an organism lives. It provides resources for food, protection and breeding. Can vary in size enormously ranging from the bark of a tree (beetle) to part of a mountain range (eagle)

Ecological Niche The way in which an organism exploits a particular habitat (for food, protection, nesting / breeding resources)

Biodiversity the variety and population numbers of all the living organisms in a ecosystem, characterised by the variety of habitat and genetic diversity.

Measurements of biodiversity indicate the stability and long term survival prospects of an ecosystem. It is the aim of conservation to maintain and increase biodiversity.

Fill in the blank spaces using the following words: biodiversity, population, species, community, habitat, genetic, ecosystem

Turdus philomelos is a ……. of bird whose …….. is broadleaf woodland. The entire ……. of *T. philomelos* is under threat. Together with other members of its food web which make up the ……. of living organisms in the wood it is declining in numbers as more and more of the …… is destroyed in the process of urbanisation. As the ……. of *T. Philomelos* diminishes, so does the …… variation. The woodland ……. .. is reaching a critical point for conservation. This is measured as an overall reduction in ……..

Measuring populations

You can't count them all so **sampling methods** are involved

- Estimates of animal populations are made in numbers
- Estimates of plant populations are made in **percentage cover** or **percentage frequency**

Random sampling methods

1. Quadrats

a) frame quadrat (see picture)

b) pin quadrat

Percentage cover or percentage frequency?

2. Capture / recapture

- a method for measuring populations of moving organisms
e.g. birds, moths, sharks

- set a trap and catch sample of population
- count them (C1), mark them and release them
- set trap again and catch a second sample
- count number of individuals in the second sample (C2)
- count the numbers of marked individuals in the second sample (C3)

$$\text{estimate total number in population} = \frac{C1 \times C2}{C3}$$

Systematic sampling

Transects

a) line transect

b) belt transect

Population growth

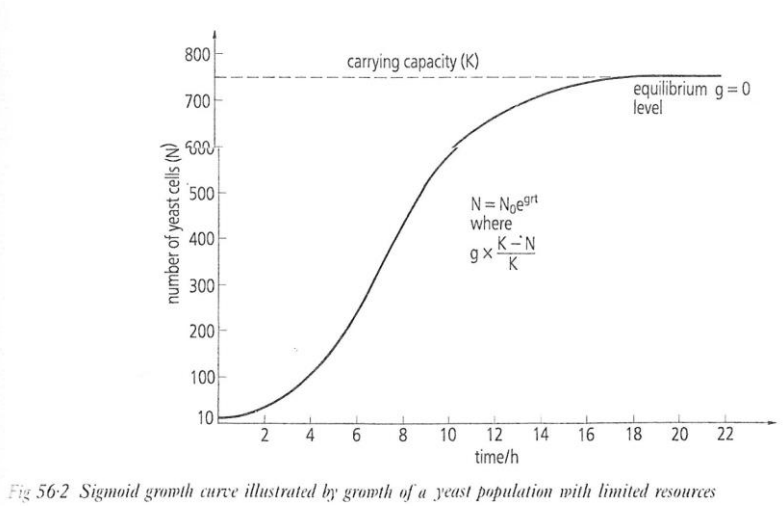


Fig 56·2 Sigmoid growth curve illustrated by growth of a yeast population with limited resources

The carrying capacity is determined by **limiting factors**

- abiotic factors: e.g. temperature, light, minerals, pollution
- biotic factors: e.g. competition (inter and intraspecific), predation

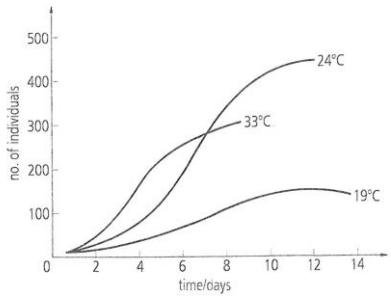
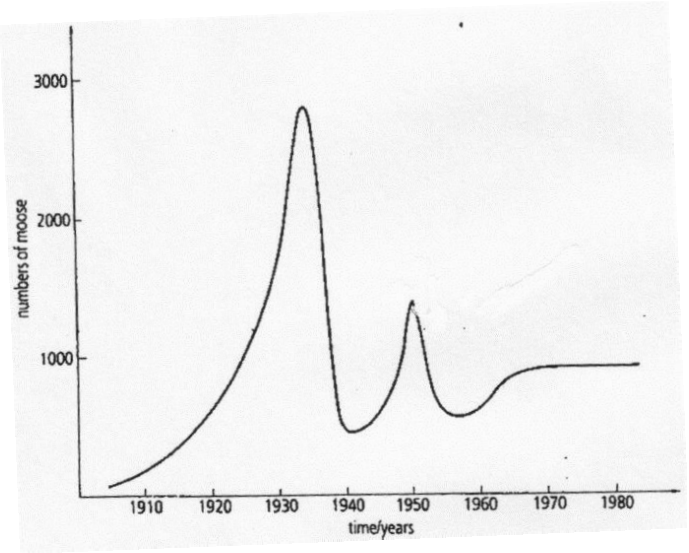


Fig 56·7 Growth curves of populations of the water flea, Moina macrocopa, *at different temperatures*

The degree of competition depends on the 'niche overlap'

If two groups are competing for exactly the same set of resources, **competitive exclusion** occurs

Predation can be a good thing!



Look at the graph here which shows the relationship between moose and timber wolves on an island in lake Superior. Moose first colonised the island by walking across the ice at the beginning of the 20th century. They were joined by timber wolves in 1949.

Conclusions?

Strategies for survival

r- strategists
short life spans, rapid generation times and many offspring. Adapted for unstable environment (A)

k- strategists
long life spans small numbers of offspring, greater parental care. Adapted to stable environment (C)

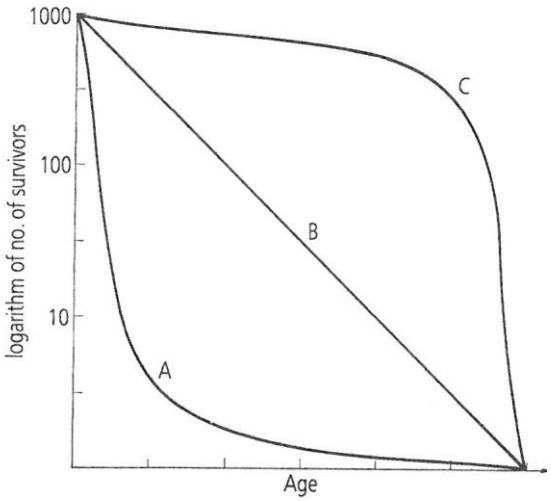


Fig 56·6 Survival curves

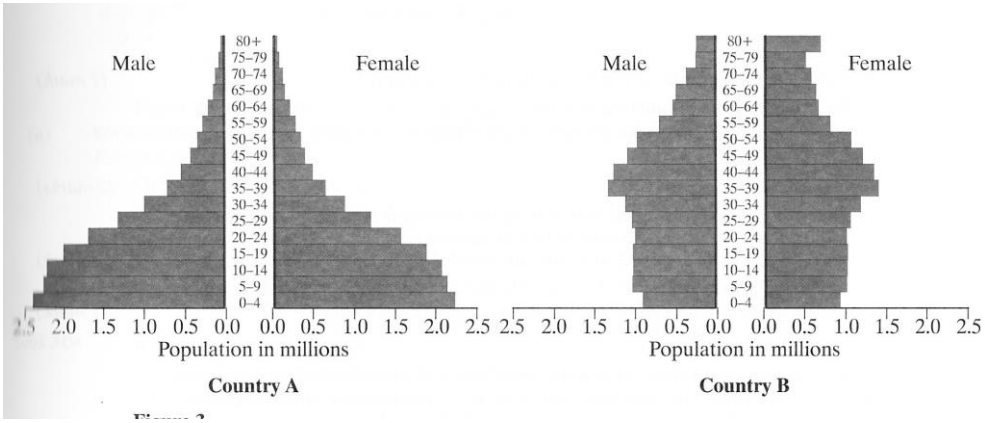
Human population growth

Birth rate = <u>no. of births per yr</u> X1000
Total pop. in the same yr

% population growth rate in a given period = <u>pop. change during the period</u> X 100
pop. at the start of the period

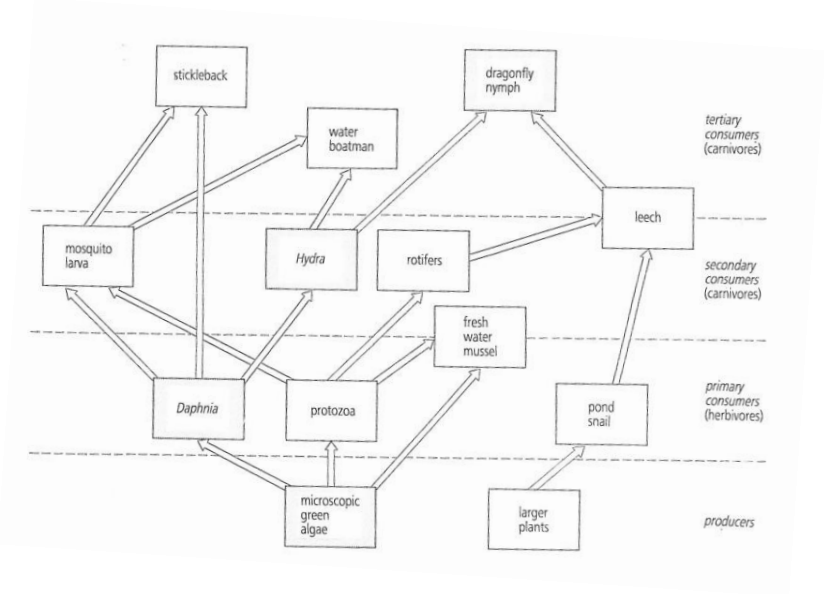
Suggest factors influencing birth rate and death rate…….

Demographic transition - Changes in age structure with economic development

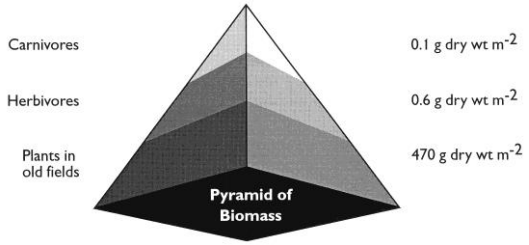


Ecological energetics

Food webs and trophic levels

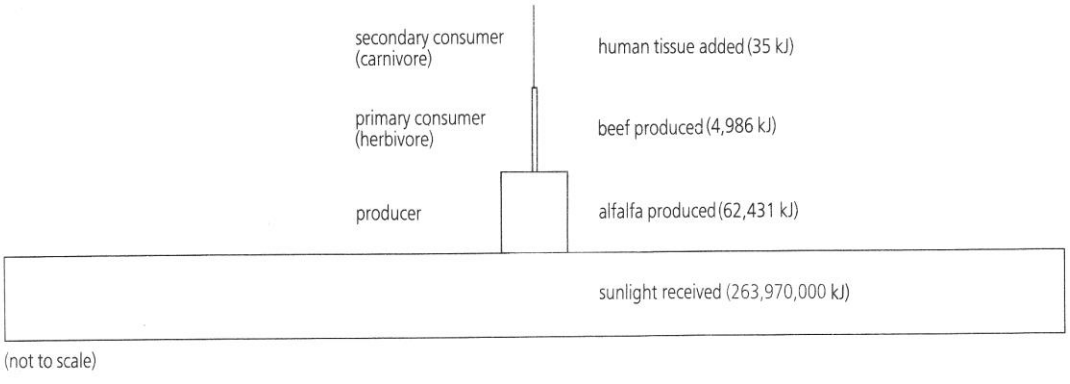


Pyramids of numbers, biomass and energy



The efficiency of energy transfer

Energy transfer = $\frac{\text{energy available after the transfer}}{\text{Energy available before the transfer}}$ X 100



Productivity = kJ per m2 per yr

Net productivity = gross productivity - respiratory loss

Intensive farming

Strategy to improve yield	**Ecological risks**
Fertilisers, NPK compounds Replace mineral nutrient lost when the crop is harvested	
Pesticides residual and persistent applied by spraying reduce the competition for the crop from native herbivores	
Herbicides kill competing plant species	
Intensive animal raising reduces losses due to respiration	
Monoculture and the removal of hedgerows	

Microorganisms and recycling

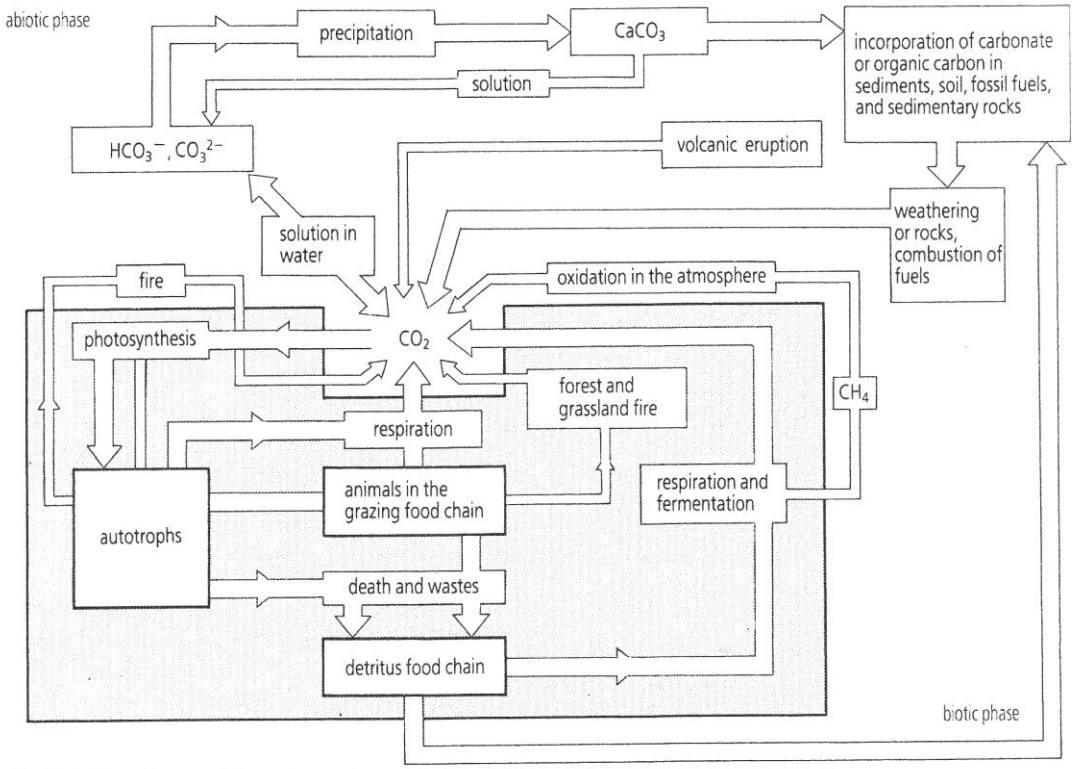
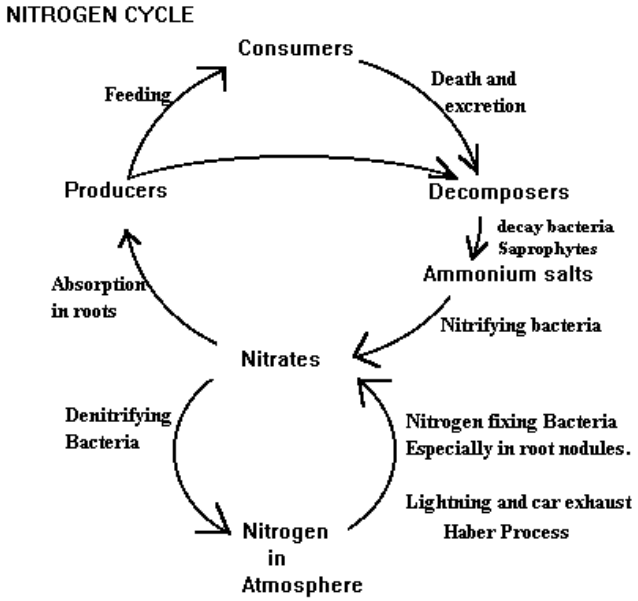


Fig 62·1 Flow diagram of the carbon cycle

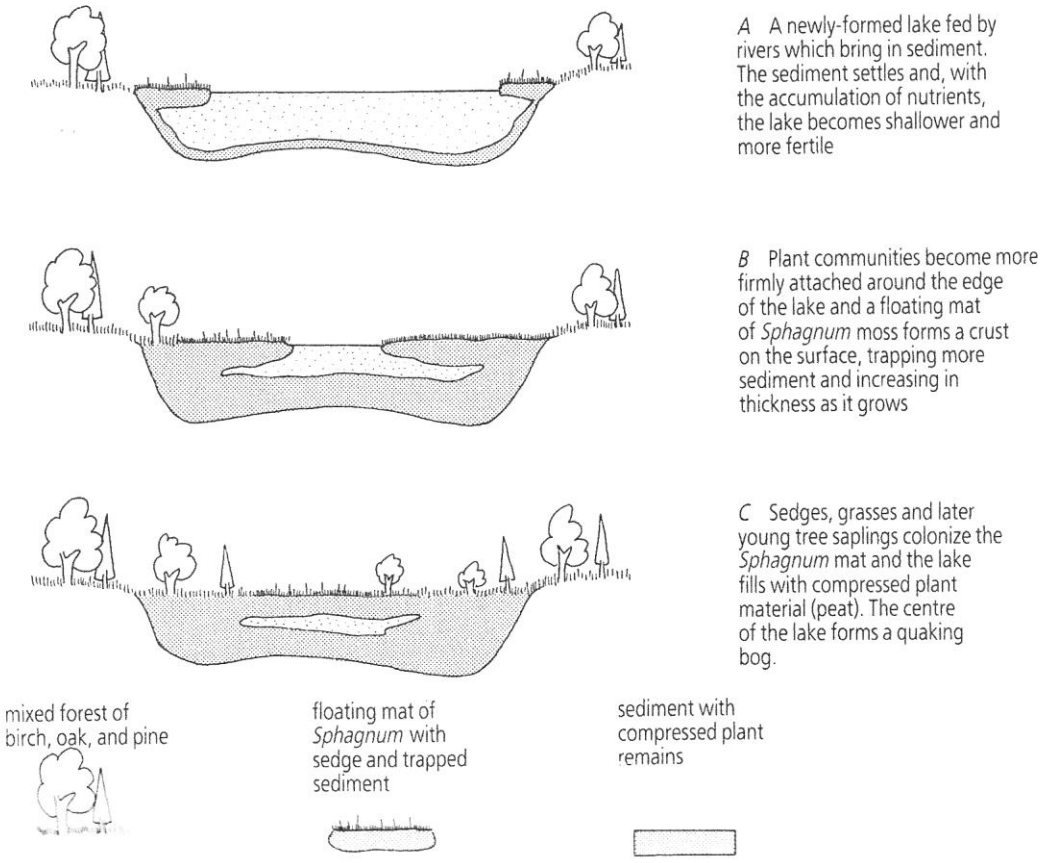


Global warming effects

- Yield of crop plants
- Life cycles of insect pests
- Distribution and numbers of wild animals and plants

Succession

- **The process of ecological change over time**

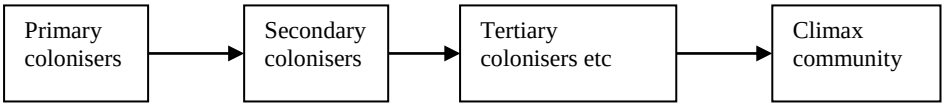


other examples of succession

Features of succession

increasing biodiversity -------->

Pioneer species mature woodland



Conservation the **management** of habitat to maximise biodiversity and prevent extinction

e.g?